

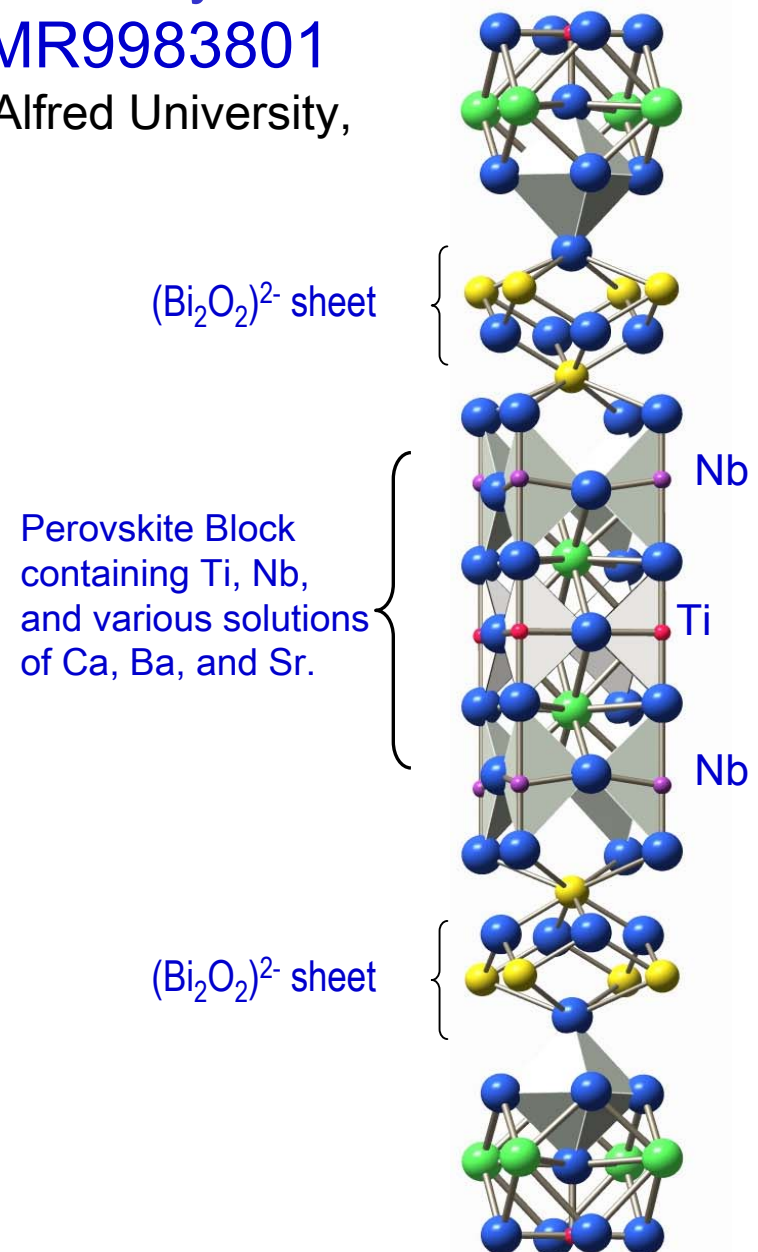
CAREER: Oxygen Ion Conduction in Layered Aurivillius-Derived Ceramics, DMR9983801

Scott Mixture, NYS College of Ceramics at Alfred University,

Ceramics with layered structures are under study for a wide range of applications including next-generation computer memory, solid oxide fuel cell electrolytes and cathodes, oxygen pumps, and catalysts.

Many layered ceramics have interesting electrical properties, including the ability to transport oxygen ions (O^{2-}) and/or electrons through the crystal, and the ability to store an electric field, called ferroelectricity.

The figure at the right shows the crystal structure of an Aurivillius phase worked out from neutron diffraction data. We have established the first direct evidence, with models, of oxygen deficiency in this class of crystals, and have shown that the oxygen deficiency changes as we substitute Ba, Sr, or Ca for the ions shown as green spheres¹. The new model is expected to clarify structure-property relations in this class of ceramics.



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In addition to studies of the Aurivillius ceramics for oxygen conduction, we are actively involved in sharing the excitement of using high-tech equipment and facilities to understand materials with students at the high school level. A freshman ceramic engineer, along with an art student, designed a “What is Ceramics” kit that includes demonstrations of fiber optics, a piezoelectric buzzer, and a strength comparison between bone and SiC.

Along with the demonstration kit, which has been distributed by request to ~80 teachers, we have an extensive website. The latest addition to the website is the “dissection” of a Pentium® computer chip. Shown at right are four images of the early stages of dissection, up to a magnification of 4000X. The later stages include diffraction experiments to determine the atomic-level structure of materials, and then linking the structure to the properties.

